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Charcot's Joint With Secondary Purulent Arthritis Treated With Intra-arterial Penicillin

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SECONDARILY infected tertiary syphilitic lesions are frequently equally resistant to anti-syphilitic measures with either the heavy metals or antibiotics and present a difficult therapeutic problem. A standard treatment by arsenicals or bismuth is ineffectual because of the superimposed bacterial infection, and although penicillin may be effective against the particular infecting bacteria and also treponemacidal, it may fail when administered intramuscularly or intravenously because of the poor permeation into the involved region. Local factors of impaired vascularity and fibro-osseous barriers prevent penicillin from gaining entrance into the involved area when the drug is administered by the intramuscular or intravenous methods; but, fortunately, by the intra-arterial route it is possible to overcome these barriers and thus achieve the desired therapeutic result. The following case report illustrates that after the failure of intramuscular penicillin therapy of a secondarily infected syphilitic lesion a prompt desirable result attended treatment with smaller dosages of penicillin given by the intra-arterial route.

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CASE REPORT

The patient, a man 64 years of age, had had swelling and purulent drainage from his left foot over a ten-year period (1935-1945) and had been incapacitated because of it many times. Since May, 1945, there had been an exacerbation of symptoms and he was finally admitted to a hospital in mid-August, 1945, and given a six-day course of 20,000 units of penicillin intramuscularly every three hours (160,000 units daily). This had no effect on the swelling or purulent drainage and both conditions continued to increase in severity. On referral of the patient to the University of Minnesota Hospital on 27 September, 1945, physical examination revealed a small, thin, fairly well developed man with a temperature of 102° F. and a pulse rate of 100 per minute. There were erythema and edema of the medial distal one-half of the left foot and two indurated purulent draining sinuses on the plantar surface of the first metatarsal of the foot. A moderate edema of the left leg extended up to the knee and an enlarged tender left inguinal node was palpated in the groin. The blood pressure was 165 mm. of mercury systolic and 68 mm. diastolic, but the heart was otherwise normal, as were the lungs.

Neurological examination of the patient revealed that the pupils reacted sluggishly to light but normally to accommodation. Anisocoria was present, with the right pupil larger than the left. Knee jerks and ankle jerks were diminished and posterior spinal column disease was further evidenced by a positive Rhomberg test, decreased muscle, tendon, joint, and testicular pain, and decreased sense of vibration and position in the lower extremities. Superficial sensation was intact. As to mental status the patient was of normal intelligence with no gross abnormalities. Venereal history was denied but a clinical diagnosis of tabes dorsalis with Charcot's joint of the foot was confirmed by a neuropsychiatric consultant. Laboratory studies revealed a hemoglobin of 10.4 gm. and a leukocyte count of 13,850 per cubic millimeter with a differential count of 84% neutrophiles and 16% lymphocytes. The blood sedimentation rate was 120 mm. in 60 minutes (Westergen). Blood chemistry determinations, including fasting blood sugar, were within normal limits. Upon urinalysis a trace of albumin and an occasional cast were found. A culture of the purulent exudate from the foot revealed coagulase-positive staphylococcus aureus to be present. Results of initial serological tests for syphilis were: Kline, doubtful; Hinton, doubtful; Kahn, negative. Subsequently, reactions to the Kolmer test were negative, to the Kline test 2+, and to the Eagle test 3+. The spinal fluid cell count was normal (2 cells per cubic millimeter) but the protein was elevated to 304 milligrams per 100 cc. A first zone colloidal gold curve was present but results of spinal serology were negative. A roentgenogram of the foot (Figure 1) showed a destruction of the first metatarsophalangeal joint with considerable fragmentation and new bone formation in the soft tissues characteristic of Charcot's joint with probable secondary purulent arthritis present.

Intra-arterial injections of 50,000 units of penicillin were given into the femoral artery twice daily over a five-day period until a total of nine injections had been given. The penicillin was diluted in 10 cc. of normal saline and given into the femoral artery in a perpendicular plane using a 10 cc. syringe and a 20-gauge two and one-half inch needle. A blood pressure cuff was placed on the left thigh and inflated to 80 mm. of mercury prior to the intra-arterial injection and maintained at that pressure for ten minutes following each injection. Foot soaks of potassium permanganate solution (1:9000 concentration) were used twice daily as a therapeutic adjunct. The cellulitis cleared entirely in 48 hours and drainage ceased in 72 hours. Following intra-arterial penicillin therapy a sterile dressing was applied to the foot and the skin had entirely grown over the sinus tracts

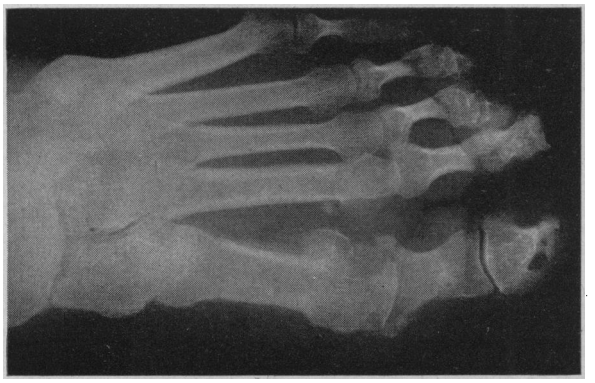

Figure 1.—X-ray of left foot revealing destruction of the first metatarso-phalangeal joint and new bone formation in the soft tissues characteristic of a Charcot's joint.

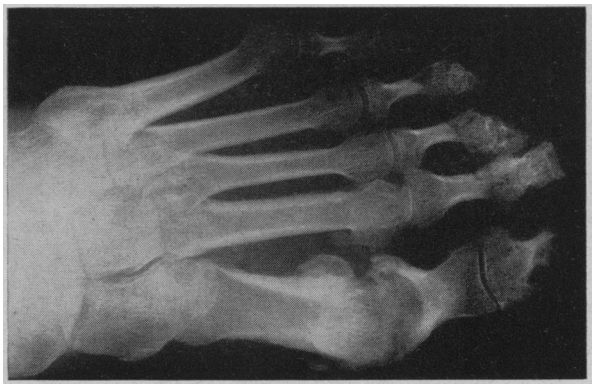

Figure 2.—X-ray revealing increase in density at first metatarso-phalangeal joint and no evidence of residual infection five months after hospital discharge.

within two weeks of the start of therapy. The patient was able to walk on the foot without difficulty following this and was discharged from the hospital on 24 October, 1945. A roentgenogram of the foot (Figure 2) taken 6 March, 1946, showed an increase in the density in the bone in the involved area at the first metatarso-phalangeal joint. There was no evidence of residual infection in the foot. The patient was followed by the neuropsychiatric clinic concerning the tabes dorsalis but had had no further difficulty with the left foot when seen one year after hospital discharge.

COMMENT

In a generalized infection without abscesses (septicemia) the determining factor of successful penicillin treatment is the effective bacteriostatic level of penicillin required in the serum as determined by the penicillin sensitivity of the infecting organism, but in a local area of suppuration (abscess) in an extremity, the permeability of the wall of the cavity is the more important since fortunately most of the bacteria found in infections of the extremities are sensitive to penicillin.[2]

Thus, in septicemia, penicillin may be given in the required dosage by the usual intramuscular or intravenous routes depending upon the sensitivity of the organism. However, in abscesses even a high concentration of penicillin in the serum may be ineffectual and the method of administration must be altered so as to obtain an effective penicillin concentration locally within the abscess. In many infections of the extremities the large area involved and the presence of multiple fascial and bony pockets have made local injection untenable but fortunately intra-arterial penicillin has been found to be efficacious in these cases. In addition the use of a blood pressure cuff placed just about the knee and inflated to a subdiastolic pressure (80 mm. mercury) prior to the intra-arterial injection and for the 10 minutes following, obstructs the venous return but permits the systolic pressure to force the concentrated drug into the local area supplied by the artery without significantly increasing the dilution of the drug.

The comparative efficacy of the intravenous and intra-arterial methods was borne out by an experimental study using radioactive phosphorus (P_{32}) and a Geiger counter for tracing in a series of normal subjects.[1] These studies revealed that every determination in the toes, dorsum of the feet, and midcalf of normal subjects, who were given radioactive phosphorus intra-arterially with a proximally placed blood pressure cuff inflated to 80 millimeters of mercury for stasis, was over the intravenous mean value for a period of three hours. This indicates that this intra-arterial method gives a higher concentration in the leg than the intravenous method during this time. For the first hour the mean Geiger counts of the determinations done on the toes and dorsum of the feet were over twice the values later determined by intravenous injection in the same subjects. Maximal values obtained with intra-arterial injection and a blood pressure cuff for stasis remained over twice the maximal values obtained by intra-arterial injection without a cuff for a period of 30 minutes and did not fall to the level of maximum values without a stasis cuff for one and one-half hours, indicating the stasis cuff permits a higher concentration than the simple intra-arterial injection for one and one-half hours. With the stasis cuff at 280 millimeters of mercury minimum values were occasionally below the mean for the intravenous method for the initial 30 minutes, indicating that the radioactive phosphorus may be withheld during this time and suggesting that the stasis cuff at 80 millimeters of mercury gives more consistent results.

Since the method of administration of penicillin is a more important variable than the dosage of penicillin, the therapeutic result in the case herein reported was better from a small dosage of penicillin given intra-arterially than was obtained from a larger dosage of penicillin given intramuscularly. The simple technique of intra-arterial injection has previously been described elsewhere and its safety is exemplified by a previously reported case of a 70-year-old woman who received a total of 30 intra-arterial injections at approximately the same site in the common femoral artery over a period of 16 days without hematoma formation or any other difficulty.[2] The present case is presented as an example of the efficacy of penicillin given intra-arterially.

SUMMARY

1. A report of a case is presented in which a patient with a secondarily infected Charcot's joint of the foot was not benefited by penicillin given intramuscularly but experienced good results later when a smaller amount of the drug was given intra-arterially.

2. Intra-arterial injection of penicillin is suggested for the treatment of secondarily infected syphilitic lesions of the extremities.

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